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PURIFIED WOOD FIBERS

Supplementing previous work on permanence of alpha cellulose of pulps and half stuffs, subjected to accelerated aging tests, samples of a new, white, rag half stuff were treated with 1 and 3 per cent bleach powder. These bleached samples thoroughly washed were made into hand sheets and subjected to the usual 72-hour heat treatment at 100° C. Control and heated samples were analyzed for alpha cellulose content. The results, which are tabulated below, check conclusively those previously obtained with the various grades of rag half stuffs and show clearly the effect of the presence of oxycellulose on the permanence of the cellulose fibers. Color permanence was also shown to be drastically lowered by the increased formation of oxycellulose.

Amount of bleach (per cent)	Alpha cellulose content		Loss in alpha
	Before heating	After heating 72 hours at 100° C.	
	Per cent	*Per cent*	*Per cent*
0	98.2	97.8	0.3
1	95.5	94.4	1.1
3	87.3	85.4	1.9

The viscosity determinations of the various pulps in copper ammonia solution before and after heat exposure are proving very interesting. In the viscosity determinations on sulphite, alpha cellulose, and old rag pulps run to date there seems to be a measurable drop in the viscosity curve (better, the time required for a certain volume under specified head

to pass through a given orifice) of those samples which have been exposed. These results greatly strengthen the belief that the aging of cellulose pulps presents not alone a chemical change but also a physical one—a change in colloidal state, arrangement, or size of cellulose particle aggregation. Such changes, although they may be caused by or brought about by the chemical changes in the cellulose itself, may not necessarily show up by ordinary chemical determinations. This may be true even though basic changes have actually taken place in the pulps, changes which may seriously affect their use for permanent papers.

In the determination of the alpha cellulose content of the representative pulp samples before and after exposure to the 72-hour treatment at 100° C. the beta cellulose content appears to increase slightly as a result of the treatment. This increase probably bears some relation to the decrease in alpha cellulose content. However, with the data available, the bureau is not prepared as yet to say that the alpha cellulose loss is entirely converted into beta cellulose. In some instances the increase is not much greater than might be expected from experimental errors.

Papers have been subjected to various accelerated aging tests for the purpose of standardizing on the one best suited for permanence investigation. The following treatments were tried: (1) 100° C. in special circulating air oven for 24, 48, and 72 hours; (2) 95° C. in circulating oven in presence of humidified air for 72 hours; (3) steam at atmospheric pressure for 2 hours; (4) exposure to actinic rays from arc lamp. In preliminary work with the light test considerable difficulty was encountered in maintaining the humidity cabinet at sufficiently low temperature because of radiated heat from the arc. Various cooling devices are being tried in order to obviate this difficulty.

The test at 95° C. in humid air offers no particular advantages over the 100° C. exposure and can undoubtedly be discarded. The 72-hour treatment at 100° C. seems to be by far the most convenient and satisfactory test, the 2-hour steam treatment offering only one advantage—the short time required for its completion.

The entire series of submitted paper samples has been heated at 100° C. for 24, 48, and 72 hours and tested, together with control samples, for bursting strength, tensile strength, tear, and folding endurance. The 100 per cent rag papers and alpha fiber papers show slight and in most cases no drop in bursting strength after heat treatment. Sulphite and 50 per cent rag paper are, however, affected appreciably in this respect. The tensile strength is only of slight interest, even sulphite papers suffering no drop. The tearing test apparently is of some importance. Rag papers and alpha fiber papers show the highest retention of tearing force, rag and sulphite mixtures are next, while all-sulphite papers are most affected by the heat treatment. Judged by this test, sized papers are more permanent than unsized papers, the reverse being true in the case of fold retention. There is a fair degree of correlation between tear retention and fold retention. With very impermanent papers the tearing force is markedly lowered. However, the drop in folding endurance caused by a 72-hour heat treatment at 100° C. seems to offer the best indication of relative permanence of the various papers.

BOOKBINDING LEATHERS

In cooperation with the New York Public Library a series of tests were made on samples of bookbinding leather treated and aged under the following conditions: (a) Exposed to gas light and gas fumes for 2,600 hours at 90° F.; (b) same as (a) but treated with a mixture of 40 per cent anhydrous lanolin and 60 per cent neutral neat's-foot oil; (c) exposed to direct sunlight and air for 240 hours and daylight for 900 additional hours at average temperature of 90° F.; and (d) same as (c) but treated with the above mixture of oil.

From each of the samples three test pieces were cut and the results were the

average of three individual tests. The test results show very definitely that the original leathers were seriously damaged when subjected to gas fumes, excepting one sample, which showed only a normal difference in strength when compared to the original leather. One sample showed complete deterioration.

Exposure to light alone gave erratic results. In two samples there was little change, and in two there was an unexplained increase in tensile strength; all the others showed some deterioration. Exposure of the treated leathers to gas fumes also gave erratic results. In three samples there was an increase in strength, while in all other cases there was a decrease. Exposure of the treated leathers to light showed an increase in strength of all samples except one, which remained the same.

Whereas the results given for the leathers treated with oil show the effects of the exposures in relation to the original strength of the leather, it is probable that the figures would be different if oil-treated leather had been available on which original tests could have been made. The general effect of oiling leathers is to increase the tensile strength.

DRYING OF OILS

Some interesting experiments were made during the month on the drying of various oils as influenced by the light from the carbon arc. It was reported last month that linseed and tung oils would dry in the carbon arc in 2 hours as compared with several days in ordinary diffused light. This month many more oils were tested. Perilla oil set to touch in 2 hours. Oils such as candlenut, poppy seed, menhaden, and soya bean set to touch in 4 to 7 hours. The so-called semidrying oils, corn, cottonseed, and rubber seed oils, were found to dry in about 24 hours. In all cases the drying seems to be remarkably accelerated by the action of the carbon arc light. Films of the same oils are being exposed to diffused light in a drying cabinet. The linseed, tung, candlenut, perilla, and poppy seed became dry to the touch after four days under these conditions.

DETERMINATION OF SMALL AMOUNTS OF MOLYBDENUM

In tests of the KCNS reduced molybdenum method for the colorimetric determination of small amounts of molybdenum (which is used in the analysis of the bureau's standard samples) it has been found that the compound formed is one of quinquevalent molybdenum, and not of trivalent molybdenum, as claimed by Krauskoff and Swartz. (Journal, American Chemical Society, vol. 48, p. 3021; 1926.) Reduction of the molybdenum by zinc and acid or by stannous chloride, as generally specified, is not satisfactory, as these gradually reduce molybdenum beyond the quinquevalent stage. A new method of reduction is being worked out with most encouraging results.

DENTAL AMALGAMS

Two reports on dental amalgams have been made to the American Dental Association by the research associate representing that organization. The first of these reports gives the results of tests on all the readily available amalgam alloy materials and discloses defects in a large number when referred to the United States Government master specification for amalgam alloys. Alloys passing the requirements of the specification are indicated in the table summarizing the tests. In all references to this report there should be kept in mind the fact that the values given represent the conditions at the close of the first half of the year 1928. Undoubtedly corrections will be made on a number of the defective materials. It is surprising to note, however, that the situation shows little improvement over that found in 1919 and reported in the March, 1920, issue of the Dental Cosmos.

The second report deals with the use of mechanical amalgamators and indicates some of the sources of injury to materials by the improper use of these devices. The need for more definite in-

structions in the operation of mechanical amalgamators is shown by a number of representative technics on representative alloys.

These reports will appear in a future issue of the Journal of the American Dental Association. The exact date of publication will be given in this Bulletin, but copies of the reports must be secured from the association, as the bureau is not planning the purchase of extra copies.

The research on dental materials is being continued on problems met in making partial dental restorations.

LACQUERS FOR WEIGHTS

The bureau is now beginning a comparative study of the amount by which various lacquers change in weight with ordinary changes in the humidity of the atmosphere. A large number of uniform sheets of brass have been made for the preparation of samples, and it is expected that observations on the first of these will be started very soon.

As a part of this work the bureau hopes to have some samples prepared by the various manufacturers of lacquered weights. Sheets for the preparation of a few samples will be furnished such makers as are willing to supply rather complete information concerning the material and methods used. The names of those who furnish such samples will not be published, but the bureau must be free to publish the results, together with the method of applying and treating the lacquer, and its composition, or other satisfactory methods of identifying it. These samples will be investigated by the bureau free of charge, and full reports on the results will be furnished at once to the maker who supplied each sample. It is hoped that this investigation will be of immediate assistance to these manufacturers in the selection of the most satisfactory material for lacquered weights. Sheets for the preparation of two samples bave already been furnished one manufacturer.

TESTING OF PIEZOOSCILLATORS FOR BROADCASTING STATIONS

In connection with the changes in frequencies of broadcasting stations under the new allocation ordered by the Federal Radio Commission the following information is given on the standardization of frequency standards:

Before the Bureau of Standards can undertake any test a written request must be received which contains the following information: (a) Licensed frequency of the station, (b) type of piezooscillator and quartz plate, (c) location and call letters of the station, and (d) name of the owner of the radio station where the piezooscillator is to be used.

A piezooscillator will not be tested unless the quartz plate is mounted in a suitable holder and operates readily. Tests are limited to complete piezooscillators.

In case a broadcasting station is now using a piezooscillator which has been calibrated by the bureau and is required to change its frequency by the action of General Order No. 40 of the Radio Commission, the Bureau of Standards will calibrate a piezooscillator for the new frequency without charge to the station. In many cases the change to a new frequency will necessitate a new quartz plate and changes in the coils of the piezooscillator. The bureau can not do this work. Grinding of quartz plates, if they have no other means of adjustment, will be done if it comes under 163e of test fee schedule 163. The manufacturer of the piezooscillator should be consulted concerning changes. In requesting a test under this provision state in addition to the information requested above—(e) test number (taken from certificate) of last test by the bureau.

In case a broadcasting station is using a piezooscillator which has not been calibrated by the bureau, it may be submitted for test and a fee will be charged according to Test Fee Schedule 163.

The piezooscillator is the only type of standard which will be calibrated for use as a station standard by the bureau. Such a standard will be calibrated for any broadcasting station which requests it. A fee will be charged according to Test Fee Schedule 163. Attention is di-

rected to the explanatory text of this schedule.

In most cases where a quartz plate is used to control the frequency of a broadcasting station directly it is not feasible to calibrate this plate at the bureau, since the entire piezooscillator must be submitted. In such cases the station should provide a separate piezooscillator which is used for checking purposes. It may then be submitted for test in accordance with the above.

Tests will, in general, be scheduled in the order in which requests are received. A copy of Fee Schedule 163 will be sent upon request addressed to the Bureau of Standards, Washington, D. C.

FADING PHENOMENA TO BE STUDIED ON BYRD ANTARCTIC EXPEDITION

L. V. Berkner, assistant radio engineer, Bureau of Standards, is now on board the ship "City of New York" of the Byrd Antarctic Expedition en route to the Antarctic regions. Mr. Berkner, in addition to his duties as a radio officer of the expedition, will make an investigation of fading phenomena, particularly of high-frequency transmissions. The equipment for this work consists of two special high-frequency receiving sets loaned by the Westinghouse Electric & Manufacturing Co. to which fading recorders have been adapted by the bureau. These recorders are similar to those used by the Bureau of Standards in previous fading investigations, and the method used will be the same.

It is expected that this investigation will give information on the effect of the concentration of the earth's magnetic field at the south magnetic pole, of auroras, temperature, height of the radio reflecting layer, and many other phenomena which affect radio transmission. Mr. Berkner will make observations upon selected stations, and some special transmissions may be arranged.

The expedition will be in the Antarctic regions for sufficient time to give observations throughout both the daylight and dark months of an Antarctic year. The bureau will keep in touch with the work by means of radio communication.

FILTERS FOR CHANGING THE COLOR TEMPERATURE OF INCANDESCENT SOURCES TO MEAN SUNLIGHT

In connection with an extensive investigation leading to the development of a large number of reproducible liquid filters for converting the color of incandescent light sources to sunlight and other high color temperatures, a filter was designed to convert the color and energy distribution of an incandescent Mazda C lamp at 2,848° K. to that of the sun outside of the earth's atmosphere. It was hoped that this might serve as a suitable daylight filter, inasmuch as but little of the sun's energy (in the visible spectrum) is selectively absorbed by the atmosphere. In other words, the relative spectral energy distribution of the sun outside the atmosphere should be closely like that of the sun plus blue sky or like that of an overcast sky.

The color of this source and filter combination has been compared with that of overcast sky on several days between September 14 and 29, 1928, the autumnal equinox period. At certain times on four different days the natural and artificial daylight were in practically perfect color match. At other times the natural daylight was slightly yellowish, purplish, or bluish, relative to the standard.

Standard artificial daylight is thus available, accurately reproducible from specification, and may be readily prepared in any laboratory. The specifications of this filter are similar to those of other Davis-Gibson filters. The exact proportions of the ingredients are as follows:

A

Copper sulphate ($CuSO_4.5H_2O$) ----------grams--	3. 125
Mannite ($C_6H_8(OH)_6$)-----do----	3. 125
Pyridine (C_5H_5N)----------ml--	30. 0
Water (distilled) to make--do----	1, 000. 0

B

Cobalt ammonium sulphate ($CoSO_4.(NH_4)_2SO_4.6H_2O$)-----grams--	25. 470
Copper sulphate ($CuSO_4.5H_2O$) ----------grams--	25, 470
Sulphuric acid (Sp. gr. 1.835)--ml--	10. 0
Water (distilled) to make--do----	1, 000. 0

One centimeter of each of solutions A and B are contained in a double cell having three plates of borosilicate crown glass (refractive index, D line=1.51) each 2.5 mm. thick. Complete spectrophotometric data will be sent upon request.

PHYSICAL PROPERTIES OF PRECAST STONE

The tests to determine the physical properties of precast stone with the object of preparing Federal specifications for this material, described in Technical News Bulletin No. 128 (December, 1927), have been continued. Forty-four samples were submitted by 20 manufacturers located throughout the United States. A few changes have been made in the method of testing since the above description was published. The dry weight of specimens was determined by heating at 110° C. until constant weight was obtained, which usually required about 72 hours. Compressive strength is determined on cylinders 2 inches in diameter and 2 inches high, a size selected because specimens of homogeneous material could be obtained from most samples of stone, including the type with facing. The compressive strengths ranged from 1,760 to 10,300 lbs./in.^{2}. Twenty-one per cent of the specimens had strengths of over 8,000 lbs./in.^{2}, 58 per cent over 6,000 lbs./in.^{2}, and 91 per cent over 4,000 lbs./in.^{2}. Modulus of rupture determinations were made on 1 by 1 by 8 inch prisms tested on a 6-inch span, and results varied from 180 to 1,575 lbs./in.^{2}. Twenty-two per cent of the specimens had a strength of more than 1,100 lbs./in.^{2}, 45 per cent more than 900 lbs./in.^{2}, and 91 per cent more than 500 lbs./in.^{2}. The rate of absorption was determined under the condition of total immersion in water on the broken halves of the modulus of rupture specimens. The amount of water absorbed, expressed in percentage of dry weight of specimen, was determined after ½, 2, 4, 6, 24, and 48 hours, and also after 5 hours' subsequent boiling. At one-half hour the absorption ranged from 0.8 to 13.1 per cent. Fifty per cent of the specimens absorbed less than 5 per cent. At 24 hours the range was from 2.4 to 14.0 per cent. Only 7 per cent of the specimens absorbed less than 5 per cent. At 48 hours the range was from 3.5 to 14.0 per cent, 3 per cent of the specimens absorbing less than 5 per cent. After 5 hours' boiling the range was from 7.7 to 19.2 per cent. Only 13 per cent of the specimens absorbed less than 8 per cent of water.

The ability to withstand weathering has been determined by cycles of alternate freezing and thawing. The specimens for this test are cylinders similar to those used in the compression test. The test specimens are placed in water for 48 hours previous to the first freezing cycle. The freezings are made while the specimens are standing in one-fourth of an inch of water. Less than one-third of the specimens have reached the end point, or point of complete failure or disintegration, and for this reason no definite conclusions as to the value of the other tests as an indication of the ability to resist freezing can be stated at this time. The end point has been reached at a minimum of 65 cycles and a maximum of 380 cycles in those specimens where the tests have been carried to completion. A half dozen specimens have already withstood 475 cycles without any indications of failure.

MEASUREMENT OF ELASTIC STRAINS IN CONCRETE STRUCTURES

A test has been made recently to determine the practicability of a method which could be used in field tests of concrete structures for distinguishing between the elastic strains produced by stress and those resulting from changes in temperature and humidity and from plastic flow or yield. In this method small blocks of concrete are cut out of the structure; measurements are made of the elastic recovery which takes place in these blocks as they are relieved from the forces acting when in the mass. The changes in strain accompanying the removal of the blocks were determined readily by means of a hand strain gauge. To facilitate the removal of the blocks, it was suggested that each should be

cast in a U-shaped trough or form. The principal object of the test was to determine whether the presence of the form material would appreciably affect the strains in the block and whether the block could be cut without injury to the gauge lines.

A concrete prism 30 by 30 inches in cross section and 36 inches in height was made for the test. The prism contained one removable block near the mid-point of each of the four lateral faces. Each block was in the form of a prism 5 by 5 inches in cross section and 20 inches in height. One of the forms for shaping the blocks was made of sheet metal about 0.03 inch in thickness. The other three were made of wall board of three different thicknesses. All were given a thin coat of paraffin to prevent bonding with the concrete. Plugs were set in the concrete for use in taking strain gauge readings in three gauge lines on each lateral face of the prism, one gauge line being in the removable block and the other two midway between the edges of the block and the prism.

The prism was placed in a testing machine and a compressive load of 600 lbs./in.^{2} applied. After taking strain readings one of the blocks was removed by cutting the concrete along each end of the block. Although this required a cut about 5 inches in length and 5 inches in depth along each end of the block, these were made easily with a small air drill. The load on the prism was then released and strain-gauge readings were made. The same operation was followed in removing another block from the prism.

The results of the tests indicate that the blocks, when separated (except at the ends) from the prism by thin forms, were cut out without a noticeable injury to the gauge lines. It was found, however, that the strain in the block cast into the sheet-steel form was only about 70 per cent of the average strain in the adjacent gauge lines, whereas for the blocks cast into wall-board forms the strains were on the average about 30 per cent greater than in the adjacent concrete. These results indicate that some provision should be made when using metal forms to prevent the steel form taking such an appreciable amount of stress as to affect the strain in the concrete block. They show further that wall board, on account of its greater thickness and lack of rigidity, is not a suitable material for such forms. Apparently the method can be made practicable for separating the elastic from the inelastic strains measured in concrete.

ENAMELED SAND-LIME BRICK

Artificial coloring of sand-lime brick has been attempted by several methods, one of which is by covering the exposed edge of the brick with a paint or enamel. The bureau recently tested the weathering qualities of brick enameled on one edge with a cellulose type enamel. The results, while unfavorable to the particular specimens tested, nevertheless may be of general interest.

The enamel was applied in an extremely thin coat to the surface of the brick. It did not hide the textural character of the surface. The brick as received were mainly cream-colored enameled, although a few specimens with a white enamel were obtained.

It was found that the enamel softened and discolored on immersion in hot water or on dry heating at 110° C. Freezing and thawing tests of the brick were made. In all cases the enamel cracked or chipped in less than 30 alternations. Specimens exposed to the weather during July and August, when compared with unexposed specimens, showed appreciable color changes. The white enamel had turned to a yellowish cream, while the cream enamel had bleached to a much lighter color.

The results indicated that this type of finish was unsatisfactory both as to permanence of color and finish. In the development of any coloring process for sand-lime brick the strongly alkaline nature of the brick must be considered.

CRUCIBLES FOR MELTING GLAZES

The physical properties of glazes are being determined at the Columbus branch

of the bureau. In connection with this work it has been necessary to develop a crucible in which the glazes could be melted. The following batch formulas for the crucibles proved very satisfactory:

No. 1. Thirty-five per cent calcined clay from Gordon, Ga. (G–3) clay fired to cone 20 and ground to pass through 80-mesh screen.
5 per cent feldspar.
10 per cent flint.
16⅔ per cent G–3 clay.
16⅔ per cent Kentucky ball clay No. 4.
16⅔ per cent English china clay.

No. 2. Twenty-five per cent calcined G–3 clay calcined at cone 20 and passed through 80-mesh screen.
25 per cent calcined alumina passed through 60-mesh screen.
16⅔ per cent Florida kaolin.
16⅔ per cent Kentucky ball clay No. 4.
16⅔ per cent English china clay.

These batches were ball-milled one-half hour and cast in plaster molds. The No. 1 crucibles were dried and fired to cone 20 and allowed to soak about 4 or 5 hours. They proved to be very good for the less corrosive glazes. The No. 2 crucibles were dried and fired to cone 23 and allowed to soak. They were used for the most corrosive glazes. Glazes containing as much as 30 per cent B_2O_3 were satisfactorily melted with very little attack on the crucibles. Glazes containing as much as 60 per cent PbO have also been made in these crucibles. The average time of melting and firing of the glazes was about 7 hours.

Some observations were also made on the difference between the batch composition of the glazes and the composition as determined by chemical analysis of the glazes after melting. The amount of the difference depended on the temperature and time required to obtain a clear melt. The batches of glass melted weighed from 1 to 2 pounds. The amount of the decrease in B_2O_3 content was from 0.5 to 3 per cent; in lead, from 0.5 to 2 per cent; in the alkalies, from 0.5 to 2 per cent; and in the ZnO, from 0.2 to 1 per cent. The amount of the increase in the SiO_2 content was from 0.1 to 2 per cent and in the Al_2O_3 from 0.1 to 1 per cent.

REPORT OF STANDARD ZETTLITZ KAOLIN TEST

At its Copenhagen meeting the International Union of Pure and Applied Chemistry voted to undertake the preparation and distribution of an international standard sample of Zettlitz kaolin and charged the Ceramic Society of Czechoslovakia with the duty of carrying out this resolution. This society established a permanent committee to prepare, distribute, and to act as custodian for this standard sample. Samples of this standard may be secured by application to The Ceramic Society of Czechoslovakia, Prague, Czechoslovakia. Samples of this standard have been distributed to the countries belonging to the union for analysis and test, and it is hoped that a comparative study of the results obtained will lead eventually to the adoption of international methods for the analysis and testing of clays for ceramic purposes.

The present report contains the results obtained in the study of the standard kaolin at the Bureau of Standards made in accordance with the methods adopted by the American Ceramic Society and also other methods in use at the bureau.

Chemical analysis	Per cent
Silica (SiO_2)	46.90
Alumina (Al_2O_3)	37.40
Ferric oxide (Fe_2O_3)	.65
Phosphorous pentoxide (P_2O_5)	.08
Titania (TiO_2)	.18
Zirconia (ZrO_2)	.007
Manganese oxide (MnO)	.007
Calcium oxide (CaO)	.29
Magnesium oxide (MgO)	.27
Barium oxide (BaO)	.02
Strontium oxide (SrO)	.006
Chromic oxide (Cr_2O_3)	.015
Vanadium trioxide (V_2O_3)	.002
Potassium oxide (K_2O)	.84
Sodium oxide (Na_2O)	.44
Sulphur trioxide (SO_3)	.03
Loss on ignition (1,050 to 1,100° C.)	12.95
Total	100.087

Summation of physical tests

Test	Clay	50/50 clay-flint mix
Softening point	Above cone 34 (1,755° C.).	------
True specific gravity	2.633	------
Dry volume shrinkage	25.8 per cent	16.1
Dry linear shrinkage	7.9 per cent	5.1
Water of plasticity	46.4 per cent	29.8
Shrinkage water	17.1 per cent	10.4
Pore water	29.3 per cent	19.4
Dry transverse strength	261 lbs./in.²	116

In the determination of the firing behavior values were obtained on specimens of clay and of 50/50 clay-flint mixtures fired to cones 2, 4, 6, 8, 10, 12, 14, 16, and 18. Only the results at cone 12 are reported herewith.

Test	Clay	50/50 clay-flint
Porosity, per cent	25.4	32.0
Fired volume change, per cent	33.35	8.75
Linear change, do	12.75	3.35
Apparent specific gravity	2.545	2.555
Bulk specific gravity	1.90	1.75
Absorption, per cent	12.9	17.5
Fired transverse strength, lbs./in.²	4,290	1,660
Modulus of elasticity, lbs./in.²	5,911,000	------
Coefficient of expansion per degree centigrade (interferometer method)	6.74×10^{-6}	12.94×10^{-6}

A detailed report of the tests made and of the apparatus and methods used in making the tests is being prepared and will be available in the near future.

SPARK ACCELEROMETER

In the course of current work on motor-fuel research it has been necessary to devise apparatus of increased precision for the measurement of automotive engine acceleration.

The acceleration of interest is that occurring in the short interval after the throttle is opened before the engine attains full speed. At first this was obtained from successive readings of a chronometric tachometer. However, in addition to being inaccurate and involving the personal equation, the tachometer, reading only once a second, obscures some transient phenomena.

The apparatus devised to overcome these difficulties is constructed almost entirely of parts commercially obtainable at low cost. It consists of a sprocket, coupled to the engine through a one-position claw clutch, which draws paper tape, of the same size and with the same perforation as 16-mm. motion-picture film, between electrodes across which a spark is periodically discharged. This spark is timed by a tuning fork, which breaks the primary circuit of an automobile ignition coil. The record consists of a series of holes in the tape, the distance between any two holes being proportional to the mean engine speed in that time interval.

In order to facilitate measurement and computation of the results, the tuning fork was adjusted to give a frequency of 360 cycles per minute. Measurement is made by passing the tape over a sprocket identical with the one attached to the engine. A microscope is trained on the tape, and the sprocket is revolved until a spark hole is under the cross hair. Reading is made on a micrometer head graduation in degrees which is carried on the sprocket shaft. Since the tuning fork splits a minute into 360 parts and the micrometer head splits a revolution into 360 parts, differences of successive readings give revolutions per minute directly.

Strictly speaking, the data give only displacement and time precisely, and acceleration is obtained only approximately by double numerical differencing. Mathematical analysis shows, however, that the error thus introduced is negligible for the purposes of the present investigation. With this apparatus speed can be measured six times a second, with a probable error for a single measurement of less than 1 revolution per minute.

MOTOR-TRUCK SPECIFICATIONS

Initial steps to form a set of standard specifications for the purchase of trucks by the Federal Government were taken last month by a special subcommittee of the motor truck committee of the National Automobile Chamber of Commerce. The primary purpose of the

proposal is to work out with the Federal Specifications Board standard truck specifications which will simplify the submitting of bids by truck manufacturers bidding for the Federal business. It is the expectation of the committee that the standards adopted by the Federal Government will eventually be followed by State, city, and municipal purchasers of trucks, and for this reason it has been announced that great care is being used in the drafting of the specifications.

STANDARDIZATION OF DIESEL ENGINE FITTINGS

Plans for standardization in the Diesel engine field are described in a bulletin of the American Society of Mechanical Engineers. The bulletin points out that certain small parts, such as piston rings and spray valves, are manufactured by specialty concerns, and that standardization would enable these manufacturers to contribute largely to the reduction of engine-making costs. A committee of the oil and gas power division is at work on the subject.

TRAFFIC CODE

The American Engineering Standards Committee has just announced the personnel of its sectional committee to prepare a code of street traffic signs, signals, and markings. The scope of this project is the standardization of signs, signals, and markings used to direct street traffic, including mechanical equipment, nomenclature, color, shape and location, definition of signal locations, types of signals, and signal system.

COMMERCIAL STANDARD FOR UNIONS APPROVED

Approval of a proposed commercial standard for malleable iron or steel screwed unions for use with standard-weight pipe was given September 24, 1928, by a general conference of interested elements of the industry, held under the auspices of the commercial standards unit of the Bureau of Standards. This commercial standard pertains to black and galvanized types of brass seated malleable iron or steel unions.

Following the presentation of the proposed standard by R. E. Bryant, of the Jefferson Union Co., Lockport, N. Y., I. J. Fairchild, of the Bureau of Standards, explained the operation of the certification plan that has been developed for industry.

The conference agreed that new production, in accordance with the schedule as defined by the standard, would begin on May 1, 1929, allowing until November 1, 1929, for industry to use up existing stocks. The standard will be subject to annual review by a standing committee, in order that it may be kept abreast of such changes as may take place in the art. Members of this standing committee are: Robert E. Bryant, of the Jefferson Union Co., Lockport, N. Y.; Myron H. S. Affleck, of the Star Manufacturing Co., Providence, R. I.; Stanley G. Cady, of the Rhode Island Fittings Co., Providence, R. I., representing the manufacturers. The Standard Sanitary Manufacturing Co.; Fleck Bros., of Philadelphia; General Fire Extinguisher Co.; Hajoca Corporation, of Philadelphia, representing the distributors. The Master Plumbers Association, the Master Steamfitters Association, American Gas Association, the Heating and Piping Contractors National Association, representing the consumers.

Mr. Fairchild stated to the conferees that the bureau would prepare the standard for submittal to industry for signed acceptance at an early date. He also called attention to the fact that at least 65 per cent of the industry, by volume of annual production, must accept the standard in writing and with no outstanding opposition from the others before it will be published.

SIMPLIFIED PRACTICE RECOMMENDATION FOR WOVEN-WIRE FENCING

A sufficient number of signed acceptances to the recently revised simplified practice recommendation for woven wire fencing, representing at least 80 per cent of the manufacturers by volume of annual production and a substantial number of the recognized distributors and

users of the commodity, having been received by the project is in effect as of July 1, 1928.

The original simplification for this commodity, Simplified Practice Recommendation No. 9, was approved in September, 1923. Through the adoption of the simplification the industry eliminated the existing varieties of woven wire fence from 552 to 69 and reduced the 2,072 existing sized packages to 138, corresponding to respective eliminations of 87.5 and 93.4 per cent.

At the last meetting of the standing committee for this project it was stated that the average degree of adherence accorded the recommendation by its acceptors was estimated to be 89 per cent.

SIMPLIFICATION FOR COATED ABRASIVE PRODUCTS NOW IN EFFECT

Following the approval of a tentative simplified practice recommendation for coated abrasive products, by a general conference of all interested elements of the industry, the division of simplified practice circularized the producers, distributors, and users of the commodity for signed acceptances to the recommendation.

This project is now in effect, as of September 1, 1928, since a sufficient number of signed acceptances, representing at least 80 per cent by annual production, have been received from the industry. At the time the project was considered by the general conference it was stipulated that industry would have until January 1, 1929, to get rid of stock manufactured previous to the promulgation of the simplification, which is known as Simplified Practice Recommendation No. 89, Coated Abrasive Products.

EXPEDITING INDORSEMENT OF SIMPLIFIED PRACTICE RECOMMENDATIONS

During the past year several of the leading trade papers have been rendering industry and the division of simplified practice an invaluable assistance in expediting the time when a simplified practice recommendation is made available to the industry after its adoption by the general conference. The exact time that the division can announce the publication of the recommendation is after the required number of signed acceptances have been received. Recently several of the trade papers have been using reproductions of the acceptance blank in their respective publication with a request to the readers interested in the particular recommendation under consideration that they tear the blank out of the magazine, sign it, and send it in to the division of simplified practice. Such cooperation is most helpful.

SIMPLIFICATION IN DISTRIBUTION

Distribution, according to the dictionary, means the "physical process of conveying a commodity from the producers to the consumers." In this sense it is synonymous with "transportation."

The economists give "distribution" a much broader interpretation by adding to physical movement all the activities, operations, or efforts connected with the "service of supply" to the consumer. In this connection transportation is but one of many operations.

Analysis of costs of the general service of supply indicates that actual freight charges per unit of sale constitute but a small part of the total cost of physical movement. Getting the goods to the freight car and getting them away again after the car reaches its destination costs a great deal more than actual transportation on the railroad. This applies in similar manner to water transportation. Recognition of this larger cost has focused attention on the opportunities for simplifying and otherwise improving material handling methods, machinery, and equipment.

In the early days of rail transportation it was often necessary, because of the diversity in track gauges, to transfer or unload and reload goods at junction points. Simplification by adoption of the present standard gauge, as well as well as standardization of coupler

heights and other features of railway equipment, resulted in a great advance in handling goods.

The advent of the "container" car for less-than-carload shipments and of the small tractor and train for use around freight houses mark further progress in this direction.

Now the "lift-truck and skid platform" method is rapidly coming into vogue. Heretofore this method has been confined chiefly to use within or around single plants. Now shippers are sending goods through to ultimate destination on skid platforms. This practice facilitates handling all along the line of movement from factory to consumer. Goods thus prepared for shipment are loaded into cars, unloaded onto trucks, and finally moved into the customer's stock rooms without breaking bulk, with a minimum of physical effort, and with a great saving in time.

Investigations already completed indicate direct savings ranging from 25 to 90 per cent in cost of packing, handling, loading, and unloading. It has been estimated that direct cost of material handling in the Untied States approximates $3,500,000,000 annually. Of this $700,000,000 is estimated as the cost of handling goods which can be shipped on skid platforms. It is estimated that this cost can probably be cut in half by wider application of this recent step toward simplifying this phase or part of "distribution."

The Bureau of Standards and the transportation division of the Bureau of Foreign and Domestic Commerce are jointly cooperating with manufacturers, distributors, shippers, and carriers interested in this endeavor. A first result of this program is the standardization of clearance heights for skid platforms at 8 and 12 inches and of minimum clearance between supports at 29 inches.

Further details of this simplification can be secured from the Division of Simplified Practice, Commerce Building, Nineteenth Street and Pennsylvania Avenue, Washington, D. C.

RECENT ACTIVITIES IN THE COMMERCIAL STANDARDS FIELD

Insecticides and Fungicides. — The standing committee of Simplified Practice Recommendation No. 41, Insecticides and Fungicides, has reaffirmed the existing schedule, without change, for another year from the effective date. Based on a factual survey conducted by the standing committee, this recommendation received 82 per cent degree of adherence from the acceptors.

Sheet Steel.—The forthcoming annual convention of the National Hardware Association will again permit an opportunity to review the year's operation of Simplified Practice Recommendation No. 28, Sheet Steel, by the standing committee. Last year this recommendation was reviewed, and the survey upon which this action was based indicated an adherence of 85 per cent. Improvement of processes, better quality of materials, more concentrated consumer demand, and other economic factors may necessitate some revision in the existing standards as contained in this recommendation. In order to supply the standing committee with data on the project a questionnaire has been sent to all acceptors requesting certain information.

Bank Checks.—In an effort to ascertain to what extent the recommended sizes of bank checks and other commercial instruments are being purchased and used by banks and other consuming interests, the bureau has sent to all acceptors a questionnaire asking for certain information which will enable the bureau to make an estimate of the volume of checks in use that conform to the simplified practice recommendation.

Resurveys.—During the third quarter of 1928, ending September 1, nine simplified practice recommendations were reviewed by their respective standing committees. Of the nine recommendations considered the action of the standing committees was supported and guided by seven surveys; in only two cases factual data were lacking. In both of

these instances the recommendations involved were revised to meet changed conditions. The results of the surveys for seven recommendations warranted no revision of the existing standards and reaffirmations were effected. Satisfactory degrees of adherence were accorded the seven commodities, the average being 82.33 per cent.

List of Completed Recommendations.—In addition to the regular monthly list of completed simplified-practice recommendations, the division of simplified practice has prepared an alphabetical index of the recommendations, which will be mimeographed and made available without charge to those interested. This list will be audited every six months and brought up to date.

Skid Platforms.—Acceptances of Simplified Practice Recommendation No. 95, covering clearance dimensions of skid platforms, are being received from all branches of the industry, including a large number of representative users in many commodity fields. With the acceptances have come a great many constructive suggestions in connection with other types of material handling equipment, indicating growing recognition of the possibilities for economies in handling and shipping, through simplification of equipment. The question of establishing standard dimensions for over-all length and width of skid platforms, to coordinate with sizes of freight cars and of motor truck and trailer bodies, is being carefully studied by those interested.

Welded Chain.—Manufacturers representing more than 85 per cent of production of welded chain have unanimously agreed upon a simplification program providing for the elimination of several hundred odd sizes from their list of standard numbers. The bureau has been requested to call a general conference of manufacturers, distributors, and users of welded chain, at which the manufacturers' recommendation will be presented for adoption.

Band Saws.—A number of manufacturers of this commodity are making a survey of trade conditions as to production and demand looking to the elimination of superfluous sizes. The bureau expects to cooperate with them in developing a simplification project as soon as their survey has been completed.

Paint and Varnish Agitators.—Manufacturers of agitators, and of steel barrels and drums, in which they are used, are being circularized at the suggestion of certain users of this equipment, to ascertain the possibilities for reducing the existing diversity in dimensions. A number of manufacturers of steel barrels and drums are already included as acceptors of Simplified Practice Recommendations Nos. 20 and 28, covering these commodities.

Singletrees.—Manufacturers of this equipment are making a survey of their sales, covering a considerable period, in order to determine a sound basis for eliminating sizes and varieties which they consider unnecessary, owing to obsolescence or small demand. When the survey figures have been tabulated, the simplified practice committee of the industry will draft a tentative recommendation for presentation to a general conference.

Steel Bathroom Medicine Cabinets.—The manufacturers of these cabinets have evinced a considerable interest in simplification, and it is contemplated holding a preliminary conference in the near future to discuss the possibilities of drawing up a simplified practice recommendation on outside dimensions and wall openings for this equipment.

Form Dimensions for Concrete Ribbed Floor Construction.—A meeting of manufacturers and dealers interested in forms used in concrete ribbed floor construction will be held this month in connection with the semiannual convention of the Concrete Reinforcing Steel Institute. The purpose of this meeting will be to discuss the revision of the tentative simplified practice recommendation which was proposed at a general conference on March 21, last.

Can Sizes.—The bureau's survey of the sizes of cans used in the packing of

fruit, vegetables, and fish has been completed and will be taken up with the can manufacturers in the near future, with a view to checking the recommendation with their production before submitting it to the National Canners' Association for action.

Photographic Paper.—A final meeting of the simplified practice committee of photographic paper manufacturers was held in New York on September 18. The purpose of this meeting was to present the proposed simplification schedule on paper sizes to manufacturers of photo frames, mounts, and paper-making machines so they could consider its adequacy to meet their requirements. The meeting approved the committee's recommendations, and a general conference of all interests to consider this proposal will be held in New York, N. Y., on October 23 at the Hotel Biltmore.

Shipping Tags.—On September 23 a meeting of the simplified practice committee of tag manufacturers was held at the Hotel Roosevelt, New York, N. Y. At this meeting the committee completed its final draft of the recommendation for paper shipping tags. The program will be used as the basis for discussion at a meeting of all tag manufacturers which will be held in Washington, D. C., on October 25, at which time the final draft of the schedule will be completed in preparation for organizing a general conferenec of all interests to develop the final recommendation.

Gummed Tape.—The industry has requested the services of the bureau in the development of suitable standards for gummed tape. The preliminary steps were taken in Detroit on September 12, when a committee of manufacturers of gummed tape and paper used for this purpose was organized to prepare suitable specifications which will be placed before the industry for consideration.

Glass Containers for Preserves, Jellies, and Apple Butter.—A general conference of manufacturers, distributors, and users of glass containers used in packing preserves, jellies, and apple butter was held in Cleveland, Ohio, on September 18, in conjunction with the mid-year convention of the National Preservers Association. A simplified practice recommendation was unanimously adopted, reducing the number of sizes (net contents) for preserve jars from 36 to 8; jelly glasses, 24 to 7; and apple butter jars, 6 to 4. January 1, 1929, was set as the effective date for production under the new schedule, and it was further agreed that the industry should have a transitional period, effective until January 1, 1930, during which time the eliminated sizes and varieties may be moved into consumption without embarrassing any element in the industry. A standing committee was authorized, to consist of three members from the National Preservers Association, three members from the Glass Containers Association, and three members to represent the grocers. It is the belief of a large number of producers of preserves and jellies, as well as the manufacturers of glass containers, that this simplification program will result in economics to the whole industry.

Glass Containers for Drug and Pharmaceutical Industry.—At a preliminary conference of representatives of the drug and pharmaceutical industry and the Glass Container Association, held at the Department of Commerce on August 10, the appointment of a simplified practice committee was authorized to make a survey and from the results obtained work out a simplified practice recommendation for capacities, sizes, etc., for the various types of glass containers used in the drug and pharmaceutical industries. The committee, which is in process of organization, is to consist of one representative from each of the 15 national associations concerned.

Beverage Bottles.—At the preliminary conference of representatives of the American Bottlers of Carbonated Beverages and the Glass Container Association, held at the Department of Commerce on August 11, the appointment of a simplified practice committee was authorized to make a survey of production and demand on the various varieties and

types of bottles used and from the results obtained work out a tentative simplified practice recommendation for sizes, heights, capacities, etc. It is expected that the organization of the committee will be completed in a few days.

NEW PUBLICATIONS

Additions to Supplementary List of Publications of the Bureau of Standards (beginning July 1, 1928)

Journal of Research [1]

Bureau of Standards Journal of Research, August, 1928, Vol. 1, No. 2 (RP Nos. 6 to 10, inclusive). Price, 25 cents (foreign, 31 cents).

Research Papers [1]

(Reprints from Journal of Research)

RP1. Accelerated tests of organic protective coatings; P. H. Walker and E. F. Hickson. Price, 5 cents.

RP2. Measurement of the tread movement of pneumatic tires and a discussion of the probable relation to tread wear; W. L. Holt and C. M. Cook. Price, 5 cents.

RP3. Absolute methods in reflectometry; H. J. McNicholas. Price, 10 cents.

RP4. Interferometer measurements of wave lengths in the vacuum arc spectra of titanium and other elements; C. C. Kiess. Price, 5 cents.

RP5. Analysis of bauxite and of refractories of high alumina content; G. E. F. Lundell and J. I. Hoffman. Price, 5 cents.

RP6. Some measurements of the transmission of ultra-violet radiation through various kinds of fabrics; W. W. Coblentz, R. Stair, and C. W. Schoffstall. Price, 5 cents.

RP7. Tinting strength of pigments; H. D. Bruce. Price, 10 cents.

RP8. Wave-length measurements in the arc and spark spectra of hafnium; W. F. Meggers. Price, 15 cents.

RP9. Tests of the effect of brackets in reinforced concrete rigid frames; F. E. Richart. Price, 25 cents.

RP10. Accelerated laboratory corrosion test methods for zinc-coated steel; E. C. Groesbeck and W. A. Tucker. Price, 35 cents.

Circulars [1]

United States Government Master Specification for—

C364. Shade cloth. Price, 5 cents.

C365. Bleached cheesecloth. Price, 5 cents.

C367. Drill (unbleached). Price, 5 cents.

C368. Window shades, Rollers, slats, cords, and accessories. Price, 5 cents.

Simplified Practice Recommendations [1]

SPR3–28 (2d ed.). Metal lath. Price, 5 cents.

SPR14–28 (2d ed.). Roofing slate. Price, 5 cents.

SPR20–28 (2d ed.). Steel barrels and drums. Price, 5 cents.

SPR37–28 (2d ed.). Commercial forms (invoice, inquiry, and purchase order). Price, 5 cents.

SPR43–28 (1st rev.). Paint and varnish brushes. Price, 5 cents.

SPR51–28 (2d ed.). Die-head chasers (for self-opening and adjustable die heads). Price, 5 cents.

SPR80–28. Folding and portable wooden chairs. Price, 5 cents.

SPR86–28. Surgical gauze. Price, 5 cents.

Building and Housing [1]

BH11. A standard city planning enabling act. Price, 15 cents.

Technical News Bulletin [1]

TNB138. Technical News Bulletin, October, 1928.

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[1] Send orders for publications under this heading, with remittance, only to Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 25 cents per year (United States, Canada, and Mexico); 40 cents (foreign). Subscription to Journal of Research, $2.75 (foreign, $3.50).

OUTSIDE PUBLICATIONS [2]

Maintenance of the volt. G. W. Vinal; Preprint of paper before American Electrochemical Society (New York, N. Y.), September 24, 1928.

Status of soil corrosion investigation. K. H. Logan; Oil and Gas Journal, (Tulsa, Okla.), p. T–209; August 30, 1928.

Chaleurs de combustion des hiules de petrole. C. S. Cragoe; Paper presented at Second Congress on Industrial Heating, Paris, June, 1928, and preprinted from Chaleur a Industrie (Paris, France).

Artificial sunlight for photographic sensitometry. Raymond Davis and K. S. Gibson; Transactions, Society of Motion Picture Engineers (New York, N. Y.), Vol. XII, No. 33, p. 225; 1928.

Health hazards in chromium plating. J. J. Bloomfield and W. Blum; Public Health Reports (Washington, D. C.), Vol. 43, p. 2329; September 7, 1928.

Compressive tests of balso wood. A. H. Stang; Mechanical Engineering (American Society of Mechanical Engineers, New York, N. Y.), WDI–50–12.

Report of conference on fatigue phenomena of metals, at French Lick, Ind., June 23, 1927. Published by National Research Council (Washington, D. C.); 1928.

Progress Report No. 6, Committee on Welded Rail Joints. William Spraragen, Secretary (Committee on Welded Rail Joints, 29 West Thirty-ninth Street, New York, N. Y.); September, 1928.

Surface cooling of steels in quenching. H. J. French, C. S. Cook, and T. E. Hamill. Preprint No. 11, October meeting, American Society for Steel Treating (Cleveland, Ohio); September, 1928.

Principles of the heat treatment of steel—an outline prepared by the metallurgical division, Bureau of Standards. First installment. Transactions, American Society for Steel Treating (Cleveland, Ohio), Vol. 14, p. 502; 1928.

Corrosion fatigue (discussion). H. S. Rawdon; Proceedings Institute of Metals Division, American Institute of Mining and Metallurgical Engineers (New York, N. Y.), p. 608; 1928.

Aluminum-beryllium alloys (discussion). H. S. Rawdon; Proceedings Institute of Metals Division, American Institute of Mining and Metallurgical Engineers (New York, N. Y.), p. 644; 1928.

Metals studied for fifteen years. H. W. Gillett; The Iron Age (New York, N. Y.), Vol. 122, No. 9, p. 509.

Problems of research. George K. Burgess; Proceedings Fifth Annual Meeting, American Association of Dental Schools (1206 Medical Arts Building, Atlanta, Ga.), p. 76; 1928.

The following articles were published in the series on How the Government Helps Business in the United States Daily (Washington, D. C.):

George K. Burgess:

Industrial products are tested for efficiency in laboratories of Bureau of Standards; September 29.

Equipment used in industry is improved through tests of efficiency and accuracy; October 1.

R. M. Hudson:

Elimination of superfluous varieties of goods is fostered to reduce costs of production; October 2.

Simplified practice in industry is fostered to reduce prices by elimination of waste; October 3.

I. J. Fairchild: Adoption of system of standard specifications fostered to facilitate sales; October 4.

A. V. Bouillon: Coordinating shipping practices; October 5.

N. F. Harriman: Systematizing Government supplies; October 6.

A. S. McAllister: Safeguarding manufacturing economies; October 8.

[2] "Outside publications" are not for distribution or sale by the Government. Request should be sent direct to publishers.

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